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ABSTRACT

In order to assess the quantity and quality of equitable access to computers in Wisconsin public schools, teachers' perceptions, opinions, and attitudes about instructional computing were examined during the 1984-1985 school year. Questionnaires containing closed- and open-ended questions were mailed to all 510 sixth-grade teachers in K-6 structured public schools throughout the state. Follow-up telephone interviews with nonrespondents obtained data for comparison of respondent and nonrespondent groups. Descriptive statistics were compiled from frequency distributions, measures of central tendency, contingency tables using the chi-square statistic, and t tests. The alpha level for significance was set at .05. The major conclusion was that equity of student access to instructional computing is closely related to the attitudes and opinions of the teachers who work with those students. Based on these findings, it is suggested that, in addition to provision of training and better equipment, program planning and training tailored to the classes of opinion and attitude already existing in the schools would decrease inequitable decisions. Supplemental materials include a list of 24 references, statistical analyses, and a copy of the survey. (Author/MES)

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A SURVEY OF TEACHERS' PERCEPTIONS, OPINIONS AND ATTITUDES ABOUT INSTRUCTIONAL COMPUTING: IMPLICATIONS REGARDING STUDENT EQUITY

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ABSTRACT

The purpose of this study was examine teacher perceptions, opinions and attitudes about instructional computing and draw conclusions about the quantity and quality of equitable access to a scarce resource in Wisconsin public schools. This goal was accomplished by surveying sixth grade teachers about the status of instructional computing and examining their responses to the computing program during 1984-85 school year.

The data were gathered by means of a mailed questionnaire that contained both closed- and open-ended questions. Five hundred ten questionnaires were mailed to all sixth grade teachers in all K-6 structured public schools throughout the state of Wisconsin. Follow-up telephone interviews with nonrespondents obtained data for comparison of respondent and nonrespondent groups.

This paper reports some of the study's significant findings both about the nature of teachers' perceptions, opinions and attitudes about instructional computing, and the potential effect of these viewpoints on the students' access to computers. The exploratory nature of this study determined the types of statistical methods that were used to analyze the data. Descriptive statistics reported in this paper were compiled from frequency distributions, measures of central tendency, contingency tables using the chi-square statistic, and t tests. The alpha level for significance was set at .05.

The major conclusion of the paper was that equity of student access to instructional computing is closely related to the attitude and opinions of the teachers who work with those students. Teachers are confused about the goals of the computing program and view shortage of time along with inadequate training and resources as obstacles to computer implementation. The provision of training and better equipment is not enough, however. Program planning and training need to address the classes of opinion and attitude that already exist in the school. Such an effort might decrease the inequitable decisons that arise under the conditions reported in this study.

A SURVEY OF TEACHERS' PERCEPTIONS, OPINIONS AND ATTITUDES ABOUT INSTRUCTIONAL COMPUTING: IMPLICATIONS REGARDING STUDENT EQUITY

INTRODUCTION

Microcomputers make computer technology increasingly available for both home and school use, yet our knowledge of the educational impact or potential of computers in our schools lags far behind the awakened public concern with "computer literacy" and "education for the future." Recent research indicates that despite the great potential offered by microcomputer technology, the scarcity of firm evidence on its educational strengths and weaknesses cautions us about the new technology's potential educational impact (Sheingold, Kane, Endreweit, & Billings, 1981, p. 4).

Enormous quantitative growth in this field has occurred, as the demands of parents, industry, and the students themselves have caused schools to purchase ever larger numbers of microcomputers (Marrapodi, 1984). This rapid acquisition of new equipment has not necessarily improved education, however. Indeed, the novelty of the computer stands in immediate contrast to the traditional attitudes, the teaching methods, and the rigid bureaucracy that had survived the initial computer invasion of the 1960s (Oettinger, 1969, in Sheingold et al., 1981). Furthermore, this immense growth in educational computing has been accompanied by inequitable practices both in the curricula and in the access of the students to the machines.

Educational equity is a complex subject, but basically it means

simple *justice* -- that all persons be afforded an "equal chance" for a good education. Justice requires treating people identically in ways in which they are equal and differently when they are unequal in some *relevant* way (Bennison, Wilkinson, Fennema, Masemann, & Peterson, 1984). It is sometimes difficult to distinguish between the two, but "inequality" does not necessarily entail "inequity." Inequalities may occur due to choice, ability, or tenacity in achieving a goal, but inequities imply unfairness (Green, 1983). One is descriptive, the other prescriptive. Fairness within the educational system sometimes calls for equal opportunities, while other times different opportunities provide equity. People are equally entitled to equitable treatment.

Several studies show that inequity exists in American computer education, (Anderson, Welch & Harris, 1984; Becker, 1982, 1985, 1986b; Schubert & Bakke, 1984; Sheingold et al., 1981), and that problems frequently arise from the moment computer literacy enters the curriculum (Lacina, 1984; Enochs, 1984). Edwards (1984) in particular distinguishes between quantitative and qualitative inequities. Quantitative inequity results from shortages of money and equipment. Qualitative inequity involves intangible attitudes and institutional biases that presumably pose a greater long-term threat to equal access and use.

But the distinction is in many ways less important when qualitative and quantitative factors combine to create inequities that cannot be eradicated by addressing one type of cause alone.

Both of them lead to inequitable decision-making: the school or the teacher responds by limiting access according to unfair priorities. For example, a shortage of computers might reinforce a teacher's current disposition to target the teacher's favored group. So even though the computer is intrinsically non-discriminatory, schools often use it selectively, scheduling access to the advantage of certain populations, (boys, affluent, or gifted students), over others, (remedial, minority, or disadvantaged students) (Schubert & Bakke, 1984; Becker, 1984, 1985, 1986b). More important, though, is the fact that inequities, no matter how distant, varying, or indeterminate their source, converge in the classroom and are closely related to the way teachers think about and use computers.

As the most salient research confirms, the teachers' particular preconceptions are crucial to the course of innovation and change. Any change or innovation in education must be meaningful to the regular classroom teacher -- that is, it must fit into the current classroom world and still cultivate the teacher's sense of educational adventure -- before any innovation can be successfully implemented. Even though many educational innovations are adopted by the most far-sighted, enlightened school administrations, they are doomed if the classroom teacher won't accept them (Cuban, 1986; Fullan, 1982; Weinshank, Trumbull & Daly, 1983).

When implementing new innovations within the schools it is imperative to consider the importance of both constancy and change (Cuban, 1986). According to Cuban, teachers work within a realm of

embedded policies and work routines which must adjust to any proposed change. He points out the positive aspects of stability and craft within instruction, and notes that because "teachers are the gatekeepers for instructional technology" (p. 37), they must be consulted and involved in the introduction of any new innovation, including educational computing. Further, the importance of *how* an innovaton is implemented is much more important than *what* is implemented (Berman & McLaughlin, 1976). It is plain, then, that the more closely computers are attuned to the existing rhythms of school life, the better the chance of meaningful computer use for all students (Cuban, 1986; Fullan, 1982). Until teachers accept the computer as a valuable part of the school curriculum and have enough of them to use, computer education will not live up to its full potential in the public schools.

Unfortunately, this simple fact has been lost in the rush to assess the impact of educational computing in the schools. As Cuban reports, most studies about the classroom assimilation of technology have limited their audience and their subject to educational reformers and administrators, rather than to teachers (1986). He points out that an effort must be made "to correct an unhealthy imbalance in most writing about classroom reform, which ignores the teacher's perspective" (p. 7). Outsiders often misunderstand educational change. As several researchers have noted, we need a more accurate study of educational change and implementation of innovations that is based on life *within* the schools (Berman,

1981; Berman & McLaughlin, 1978; Sarason, 1982). Thus, any change in teaching practice requires the investigation and assessment of the teacher's viewpoint at the succeeding stages of planning and implementation, as well as a clear definition of what is to be implemented. "Who implements?" is just as important a question as "what are we implementing?"

One stumbling block to answering these basic questions is the unfocused quality of educational computing's objectives. If computer literacy is the goal, then the ongoing debate about its definition needs to arrive at a practical consensus that teachers can grasp. For if they do not understand it, then their efforts to teach it will be diffuse, frustrating, and eventually harmful to the program and to the students. Moreover, because the teacher's selection of a type of instructional use can promote or retard the learner's heuristic, cognitive development, uninformed decisions can deprive students of equitable, effective access to the machines. Equitable access, equal opportunity, and a clear understanding of objectives all go together (Alvarado, 1984; Anderson et al., 1984; Becker, 1986b, 1982; Edwards, 1984; Lesgold & Reif, 1983; Sheingold et al., 1981).

Any diagnosis of the inequities in current educational computing reveals many of our present social ills. So it is important to caution that the desirability of equal access must be tempered by a wise concern for diversity in education. If the microcomputer's strength is its adaptibility and capability for individualized instruction, and if mutual adaptation to local needs is

characteristic of computer implementation, then it is possible that this admittedly neutral piece of equipment can reinforce our existing prejudices while it encourages individual initiative and higher-order thinking.

While we debate these difficult questions, the schools continue to struggle with implementing this innovation. And our most imaginative dreams about ideal computer use in the schools may easily be dashed by the most basic attitudes and behaviors that, for whatever reasons, differentiate humans from each other. Thus any successful implementation of computer education must plan for these existing inequities, try to ameliorate their excesses, and attempt to bring the value of computer literacy to as wide a constituency as possible.

PURPOSE

The purpose of this study was examine teacher perceptions, opinions and attitudes about instructional computing and draw conclusions about the quantity and quality of equitable access to a scarce resource in Wisconsin public schools. This goal was accomplished by surveying sixth grade teachers about the status of instructional computing and examining their responses to the computing program during 1984-85 school year. The study examined several variables related to the implementation of microcomputers in Wisconsin elementary schools, including teachers' opinions and the

extent of teachers' training, student:computer ratio, geographic region, the influence of district wealth, and school planning for instructional computing. This paper does not summarize the entire study. It reports findings about certain aspects of student access to computers, and about teachers' opinions and attitudes toward instructional computing which may affect equity of student access.

METHODOLOGY

The data for this study were gathered through a survey instrument mailed to all full-time sixth grade teachers in all K-6 structured public schools in Wisconsin, and then were analyzed through appropriate statistical techniques. The first and second mailings of the survey instrument garnered 55% and 17% respectively, for a total of 72% of the 510 teachers in the sample; 369 respondents. Follow-up telephone interviews with non-respondents helped to control for variations between respondent and non-respondent groups. T-tests and chi-squares on several variables revealed no significant differences between the two groups.

The questionnaire and research design incorporated two levels of measurement: district or school data, (financial conditions, the existence of current instructional computing curricula, geographic region, basic demographic data), and individual teacher data, (measures of attitudes and opinions about various aspects of instructional computing at the school, the extent of training and

preparation for educational computing, and descriptive data about availability of machines). Financial conditions and certain demographic data were obtained from the Wisconsin Department of Public Instruction (DPI). A copy of the questionnaire is appended to this paper.

Because this survey sampled all sixth grade teachers in the selected schools, regardless of their current or past contact with computers, each sampled school contained between one and three teacher respondents. Due to that characteristic of the sample, and because the teacher was of primary interest of this survey, the teacher was the unit of analysis for all questions except those specifically concerned with school level data. The analyses of school data included each school only one time, regardless of the number of teacher respondents representing the school.

The survey instrument specifically asked how teachers were implementing computers, considering the influence of both the number of machines and time pressures natural to the school day. Focused questions were used to discern and elaborate teacher perceptions, opinions, and attitudes about issues surrounding instructional computing and to learn about patterns of microcomputer usage, the composition of groups receiving instruction, the various instructional applications of computing, and the equity of access among students. The survey suffers from weaknesses common to all such polling techniques; the teachers' answers were subjective and

limited both by the requirement that they quantify their views and by their unique position in the school hierarchy.

Statistical analysis of the resulting data provided valuable insights into teachers' opinions and attitudes, and the relationship between equity and implementation practices, while offering promising suggestions for future research. All findings of significance were at the .05 level, unless otherwise noted.

RESULTS AND DISCUSSION

INEQUITIES IN WISCONSIN'S EDUCATIONAL COMPUTING

Material Inequities

Do all schools have computers? If so, are those computers distributed in the same ratio among schools?

All of the school districts respresented had at least one computer and the large majority of schools within those districts had their own computers. Only 17 of the 369 teacher respondents reported no access to computers at all. Those 17 teachers represented 14 schools which were spread throughout several districts, CESA regions and counties. This distribution indicates that although all school districts had computers, the distribution of computing resources within districts varied.

Of the 238 schools with computers, 55% had five or fewer computers and 85% percent had between 1 and 10 machines; only 15% had more than 10 machines. The median number of computers per school (5)

and the ratio of students per computer (58:1) were lower in Wisconsin than in the nationwide sample (6 and 60:1), reported by Henry Becker, of Johns Hopkins, in a study conducted during the same semester as the study reported here (1986a). Although schools with higher enrollments had a larger number of computers, an analysis of variance showed that the increase in number of school computers was not proportionate to the increase in enrollment, suggesting that school microcomputer purchases were not based upon the enrollment, but on other factors.

Do students receive enough instruction and practice time to become competent computer users?

Seventy-nine percent of the teachers stated that their schools needed more computers, and 77% believed that students did not receive enough instruction and practice time to become competent computer users. Over half of the teachers believed that the main reasons for lack of instruction and practice time were not enough access to computers and time constraints of the regular curriculum (Table 1). Insufficiency of resources was reported by Becker (1982) as the major complaint during the early phase of microcomputer implementation. The emphasis on curricular time constraints reported in this study indicates that schools need more than additional numbers of computers. Instructional programs need to be developed which use the computers to promote student learning of instructional goals, not

goals of a specific computer program.

[Insert Table 1 about here.]

Perhaps the shortage of computers promotes the attitude that an important resource should be rationed or that its future in the school is uncertain and therefore that important elements of the curriculum should not depend upon its limited availability. The structure of the elementary classroom and typical teaching practices generally lend themselves to group instruction and common activities among larger groups of students. A creative teacher can certainly find ways to promote individual or small group activities, but that does take more planning, preparation and follow through; something the average teacher may not be able to do given the demands that already exist in the job.

Spacial Inequities

Several factors -- location, length of time computers could be kept, how often classroom computers were used, and how many hours they were actually turned on during a day of use -- highlighted inequity of access to computers among sixth grade students. The large differences in the total time each student had access to a computer in the classroom depended upon the total amount of time allocated for specific classrooms to share the computing resource; classroom access ranged from zero days to the entire school year. Furthermore, different patterns of computer access reported by

teachers indicated that students' access to computers might very well depend on the enthusiasm of the particular classroom teacher.

Of the 352 teachers with computers in their schools, about 80% claimed that fewer than half of the students used computers on a regular, weekly basis. The major reasons teachers gave for "less than weekly use" were divided among problems concerning remote location of computers, time constraints of the main curriculum, and lack of teacher training. Following in order of importance were lack of computers, funding restrictions to specific student groups, lack of necessary software, undeveloped program, funding limitations to specific curricular areas, and lack of student interest (Table 2).

[Insert Table 2 about here.]

Curricular Inequities

Fifty-seven percent of the schools did not require any instructional computing for students; in fact, five percent of the schools did not have computers. This study showed that 43% of the schools required instructional computing for students, but it cannot be assumed that those requirements were based on equivalent skill levels or equal amounts of time at the computer.

Which students were most likely to use a computer?

Two hundred thirty-two teachers (62%) had computers in their classrooms at some point during the school year; six of them (2%) did not supervise computer use themselves, but gave the responsibility to

another adult. Sixty-four (27%) of those teachers with classroom computers indicated that only certain students within their classrooms used a computer at some time during the school year. Those teachers were asked, via an open-ended question, to identify which students were most likely to use a machine. According to Table 3, the students most likely to use a computer were those who had their regular work finished, were interested, competent, above average achievers, or had a computer at home.

[Insert Table 3 about here.]

Clearly, teachers who required that regular classroom work be complete prior to using a computer imposed a restriction on use which treated computers as an "extra" in relation to the regular curriculum. Witholding the computer until regular schoolwork was finished supports Cuban's (1986) finding that instructional media, including the computer, are often viewed as an "extra." If computers were used to support the regular curriculum, all students would have a need to use a computer to complete a project and teachers could hardly require that all work be finished prior to using the tool intended to help complete that work.

The requirement that students be competent prior to using a computer also deserves comment. Students who are novices may not be able to get the help they need to use a machine, thus those who are experienced may gain more experience while those who are inexperienced are prevented from gaining the experience. The various

instructional uses of computers can, if improperly implemented, divide communities and groups by creating "haves," who are equipped with an effective survival skill, and computer-illiterate "have nots," who are ill-equipped to cope wih the age of computer information systems (Anderson et al.,1984).

In spite of reports in the literature that more aggressive students get to the machines first (Fisher, 1984; Schubert and Bakke, 1984), this study indicated only one response of that nature. However, it is possible that aggressiveness is inherent within other statements.

What general quality of computer use regarding high- and low-level thinking skills do teachers report; are equivalent skill levels of computer use reported for student groups of gifted, average, and remedial learners?

If low-level thinking skill uses encourage rote memorization under the control of the program, and high-level uses promote independent thinking and stimulate curiosity, then the degree of the learner's exposure to these techniques can either stunt or improve computer literacy in terms of cognitive development. The teachers summarized their perceptions about the general quality of computer use regarding high- and low-level thinking skills for each of three student groups of gifted, average and remedial learners by filling in a matrix with the percentage of usage along these categories. It is

possible that many of them did not know precisely what the percentage of usage was for certain groups of students not under their direction; some of them had difficulty filling in the matrix. The results, nonetheless, are quite interesting. They were tabulated, categorized, refined, and through a process of elimination, further tested in order to measure the quality of students' learning activities with the computer. A glance at Table 4, which displays the mean percentages of all categories, reveals that the mean percentages of use reported for spreadsheets, data bases, telecommunications, robotics, and other were quite lower than in the remaining categories in the matrix. Therefore, those five categories were not used for the analysis in this section.

The games category had the highest mean percentage among the types of computer activities reported for gifted students, followed by drill and practice, and then writing programs. Average and remedial students used computers in two predominant ways; mostly drill and practice, followed by games. Many computer games are nothing more than drill and practice, while others are sophisticated simulations requiring a good deal of strategic thought. Even though the games category appeared to be substantial for all three student groups, games were excluded from the analysis here because the crudeness of measurement did not allow refinements to assure that the thinking skill level was equivalent for all types of games reported. A two-way analysis of variance showed that in general, teachers

reported the most usage for average students, followed by gifted, then remedial students (see Table 4).

[Insert Table 4 about here.]

After elimination of the above mentioned categories, the remaining categories were combined into related high- and low-level thinking skill groups. The high-level skill group, then, included writing programs, word processing, and simulations, while the low-level skill group covered tutorials, drill and practice, and demonstrations. Table 5 shows a breakdown of the high- and low-level skill activities for the general sixth grade student population. According to teachers' reports, students received about four times (24%) as much drill and practice as any of the high-level skills. The drill and practice category also had the most variation among the six activity types included here. The minimum of zero for all groups indicated that at least one teacher reported no use at all for each category. Ratings of 100% in the categories of write programs, and drill and practice, indicated that all sixth grade students in certain schools were engaged solely in writing programs or in using drill and practice software. Also, the mean total of low-level usage was nearly twice the mean total for high-level usage.

[Insert table 5 about here.]

In a further refinement of this data, the total high- and low-level activities were separated into the three student groups of gifted, average, and remedial learners. It became obvious that

gifted students were engaged in more high-level activities, while average and remedial learners were engaged in more low-level activities. This is apparent in Table 6, which shows the mean of high- and low-level usage for each of the three student groups. Results of Wilcoxon matched-pairs signed-ranks tests on high- and low-level use between the student groups confirm these differences as significant (see Tables 7 & 8). High-level use was greatest for gifted students, followed by average students and least for remedial students. Low-level use was greatest for average students, followed by remedial students and least for gifted students. This finding is consistent with earlier reports about qualitative inequity in instructional computing (Alvarado, 1984; Anderson et al., 1984; Becker, 1984; Sheingold et al., 1981).

[Insert Tables 6, 7 & 8 about here.]

WHAT TEACHERS THINK

The Benefits of Computing

The teachers' attitudes and opinions about the value of educational computing in their schools varied widely and reflected a general confusion about the purposes of the program. All teachers, regardless of whether their schools had computers, were asked their opinions about the best aspects of instructional computing via an open-ended question. Responses to the question were categorized and

are shown in Table 9. Although many teachers believed that the program had some value, they were divided on what that value was and how it should be related to the purposes of educational computing. Clearly, student motivation was the predominant factor that teachers believed was most valuable -- one hundred seventeen teachers listed "motivation" as their top choice.

Teachers commented that instructional computing added interest, posed a challenge, could be used as a reward, and offered a change of pace in the school day. It may be true that students tend to be highly motivated by computer use, but one must then wonder about the depth, quality, and educational consequences of that motivation. Are students stimulated by the computer's novelty? If that is the case, then how long will the motivation last after students get used to the machines? Here again, the need for teacher training and a solid plan for implementation needs to be emphasized so that students are challenged with new experiences with instructional computing as they progress through the grade levels. Apparently there is a striking preoccupation with the immediate classroom environment and not much understanding about the larger purposes of educational computing. After all, "motivation" could justify any number of questionable innovations in the school.

This preoccupation with keeping students interested and motivated is a natural concern of the modern teacher. And certainly it does not indicate a myopic view of computers, either. In fact, a

number of teachers believed that the program's value was in its preparation of the students for survival in the computer age, and for life in general. Interestingly, only a small number actually pointed to either the higher-order thinking skills or the particular abilities that computers supposedly cultivate.

[Insert Table 9 about here.]

The second most frequent response in Table 9 (nearly 20%) is the need to prepare students for life in the future. Teacher comments here reflected the need to keep up with the changes in technology and society by at least creating or maintaining student awareness of these issues.

Despite strong claims that instructional computing helps or increases learning, only 11% of the teachers specifically indicated that as a benefit. This category was viewed separately from the category of logic, which drew about five percent of the responses. The logic category included specific reference to problem solving or critical thinking skills. Although these logic skills may be thought to increase learning, the researcher kept the categories separate on the basis of the tone or wording of the teachers' responses. Clearly different emphases were being made.

Ten percent of the responses comprised the fourth largest category in Table 9, that of job preparation. Teachers claimed that students need to be prepared for the job market of the future and that instructional computing offers skills in typing and word

processing, as well as unspecified job and life skills. If job skills are to be the goal of instructional computing, then more emphasis needs to be placed on both defining the skills needed to achieve that goal and providing an opportunity for all students to be exposed to quality computer education. Schools can hardly justify preparing some students better than others for the job market.

Twenty teachers claimed that there was absolutely nothing good about instructional computing. Those who indicated "variety" specifically referred to *potential* versatility of software. They did not necessarily like the software currently available. See Table 9 for details about other opinions expressed regarding the best aspects of instructional computing.

Who Ought to Have Access?

Confusion of attitudes and opinions about the goals, value, and general validity of educational computing were particularly clear when the teachers were asked what their preferred criteria for access to computers would be, given a hypothetical shortage of machines that would force them to ration usage. This question was directed to all teachers, regardless of whether or not their schools currently had computers. (Several teachers commented that their schools did have a shortage of computers so the question seemed more realistic than hypothetical; and considering that shortages of machines ranked high among teachers' complaints about actual conditions, the responses to

this question were suggestive of the kinds of decisions about access actually made in these schools.) Although the largest number ranked "equal access" as their highest standard, this criterion co-existed with views that hardly promote equal access, even in a rationing situation.

The main response categories that the teachers wrote in are listed in Table 10. Equal (their term) access was the most predominant of any single consideration, comprising nearly 37%, of the 252 teachers who responded to this question. Although 75% of the 369 teachers sampled believed that schools had acquired microcomputers before teachers were trained to use them, the second most preferred criterion for determining access was the ability of the students' teacher. This criterion clearly would prevent some students from having access to a computer at all, especially those whose teacher believed that computers had no place in the schools. In Wisconsin, most schools do have computers and some teachers are eagerly using them, so teachers who defer to more competent colleagues in the determination of access to the machines are also depriving their students, regardless of their educational needs, of access to the computing resource. Because elementary schools tend to be more self-contained in structure than the older grades, this criterion of teachers' competency might have a more serious implication for sixth grade students than for junior high or high school students who are exposed to more variety of teachers.

[Insert Table 10 about here.]

Two other categories mentioned by about 25% of the teachers stressed the motivational or remedial purposes of computing. "Motivation" meant that the computer should be used as a lever to encourage good behavior. Better-behaved students would have a better chance of getting to the machine. Does this mean that students with behavior problems (or personality conflicts with their teachers) do not deserve the same chance to develop skill at using computers? This access criterion conflicts with the others teachers listed, because poorly-behaved students will not have an adequate chance to reap the benefits, (develop higher-order thinking skills, or prepare for the job market, or obtain necessary life skills), that teachers claimed. This type of restriction underscores the fact that the goals of instructional computing are unclear and that computers are not viewed as a regular part of the standard curriculum which is accessible to all students at some level. Behavior modification is not one of the objectives normally associated with computer literacy, any more than it is an accepted goal of the math, science, or language curricula.

The category of remedial reinforcement was explained as basic drill and practice for students who needed to develop their academic abilities. Even though giving priority to remedial students might seem to favor some students over others, it is important to remember that all students do not have the same needs. The danger inherent in

remedial usage is more likely to lie in the steady diet of drill and practice programs, which do little to harness the student's interest in the computer to the development of higher-order thinking skills.

General Problems

All teachers were asked to state their beliefs about the worst problems, in general, with instructional computing. This, like the preceding question was open-ended; responses were categorized and results are reported in Table 11.

[Insert Table 11 about here.]

The teachers' major complaints about instructional computing focused on material, managerial, and training problems. Heading the list, claimed by about 36% of the 293 respondents, was the shortage of computers and/or software. Within this category, some teachers mentioned that lack of space in which to put the equipment prevented an increase in inventory. Similar comments referred to the unjustifiable expense of computer education relative to other important curricular priorities, and to the poor quality of software (10.9% each). Teachers were concerned that commercially available software did not match their curriculum's requirements for skill level and content.

Major managerial concerns included time constraints of the daily curriculum (25.3%) and time limitations in teachers' schedules (9.6%). If combined, these two categories might represent a larger

category of general time concerns, becoming the most predominant single problem; even greater than lack of program direction or teacher training. Time limitations in the teachers' schedules reflected the need to properly plan for use of instructional computing, both in reviewing software and planning for implementation into the existing curriculum for both long range and immediate use. The importance of repeated statements about time concerns throughout the questionnaire cannot by overstated, especially in consideration of Maftoon's claim that time constraints are one of the four main reasons for failure of innovations to be implemented (1982, in Cuban, 1986.)

About 20% of the responses blamed inadequate teacher training for the problems of instructional computing. Another 17.7% faulted the lack of program direction. In fact, the teachers reported a dismal median of three hours of inservice training as their only directed experience with computers. These figures, reinforced by the frequent appearance of similar complaints throughout the questionnaire, put into sharp focus the limited and often confused quality of the teachers' understanding of the objectives of educational computing.

These material and managerial complaints could be resolved within the context of a plan to redress shortages and provide training, but a significant number of responses to this question revealed an underlying unease with computer education in general,

regardless of material or managerial factors. A number of teachers indicated that many teachers question the value of educational computing, are aware that their fellow teachers don't care about or are afraid of the program, and believe that the program's touted objectives are unrealistic. Questionable educational value was mentioned by both those who had and had not used instructional computing. Certainly teachers need to believe that there is educational value to any proposed innovation if they are to implement it in their classrooms (Cuban, 1986; Fullan, 1982; Lortie, 1975; Miles, 1980). Until teachers are convinced of the value of instructional computing, they will make no more than a half-hearted attempt to use it. Fear of change is an obstacle that cannot be successfully overcome until the those responsible for making the change understand and appreciate its value (Cuban, 1986; Fullan, 1982; Kanter, 1983).

In a different part of the questionnaire, teachers with computers in their schools had been asked what major problems had been experienced with instructional computing in their schools. As indicated in Table 12, lack of time, computers, and teacher training lead the list. This is consistent with the top three problems reported in Table 11. Lack of program objectives and poor quality software also were indicated consistently. The emphasis on such management issues as supervision and grading procedures, suggests the extent to which teachers who use computers are still struggling to

fit them into their normal routines. This is another area worth noting since ease of implementation into the regular classroom routine is a major factor in the success of educational innovations (Berman and McLaughlin, 1978; Cuban, 1986; Fullan, 1982; Lortie, 1975; Miles, 1980; Sarason, 1982).

[Insert Table 12 about here.]

Differences Among Teachers: The Split Between Users and Nonusers.

Approximately one third of the teachers responding to this survey did not use computers at school. Table 13 documents the nonusers' reasons for their decision to avoid computer education. Four-fifths of the teachers claimed that remote location of the computers caused difficulties with scheduling access to the machines or supervising the students. Seventy-six teachers cited a shortage of equipment, while large percentages pointed to the management difficulties arising from these material and spatial factors. Finally, 64.3% of the teachers blamed the absence of training that would overcome their apprehensions about computing.

[Insert Table 13 about here.]

In sum, when asked to explain why, unlike some of their colleagues, they had decided against using computers, these "nonusers" raised the same complaints common among the users of machines. Indeed, the most interesting thing about these two groups is that they reacted differently to common problems. Nonusers

responded by avoiding computers. But users, who brought up the same complaints, still tried to keep computers in the classroom. One group refuses to change because the machines present too much of a challenge to their current attitudes, practices, and environment. The other group is trying to change, but finds the going rough.

It is not surprising, then, to find that users and nonusers have different attitudes about the utility, validity, and general worth of computers in the schools. Chi-square tests performed on the categories of access criteria, best aspects, worst aspects, and major problems by sex, age, and use/nonuse of computers revealed these important discrepancies. Significant relationships at alpha .05 or less are shown in Table 14.

[Insert Table 14 about here.]

Several questions were intended to measure positive attitude, negative attitude, discriminatory attitude, and attitude about the teacher's own competence to use computers for instruction. Questions intended to measure these attitudes were based upon a Likert-type unipolar scale of 1-5 with values as follows: 1 = Strongly Agree, 2 = Agree, 3 = Undecided, 4 = Disagree, and 5 = Strongly Disagree. Questions were grouped according to the type of attitude; values for each group were then summed, creating interval scale measurements.

Positive attitudes were measured by the degree to which teachers agreed that computers were a welcome addition to school curricula, a necessary investment for schools, enhanced the quality of education,

were helpful in teaching language arts, and the degree to which teachers felt more computers would promote access for more students. Language arts certainly is not the only subject area application of computers, but is one indication of assimilation into the existing curriulum.

Negative attitudes were based upon teachers' reactions to statements that computers complicated the teacher's job, diverted attention from basic curricula, computers were a passing fad, money spent on computing would be better spent on other materials, and that computers should be reserved for the high school level instead of the elementary grades.

Discriminatory attitudes would be revealed by reactions to statements that computers were more appealing or necessary for boys than for girls, prediction that handicapped students would not succeed with computers, and priority for computer use should be given to specific student groups.

Teachers' attitudes about their own competence to use computers for instruction were also important. Questions about competency addressed the ability to teach with some kind of computer software, to understand the operational logic of computers, to teach programming, and to use telecommunications or robotics in the classroom.

T tests on positive attitude, negative attitude, discriminatory attitude, and attitude about competency, by sex of the teachers,

showed no significant differences for any of the four variables. But as Table 15 shows, T tests on the four attitudinal categories between teachers who had used and had not used computers during the school year, showed a significant difference in all areas. The lower group means indicated that those teachers who used computers had more positive attitudes toward instructional computing and stronger feelings of competence. Those teachers who had not used computers had more negative and discriminatory attitudes toward instructional computing. The point here is not that the schools are divided among those who like computers and those who don't like them, but between those who are willing to use them and those who are not. Nonusers are not convinced that computer education is worth the effort to adjust their current practices; users are making the effort, but with difficulty.

[Insert Table 15 about here.]

Teachers' age was divided into two groups; those age 40 or younger, and those age 41 or older. The age grouping was selected based upon the mean age of 42 for the total sample group of teachers. Results of the T tests in Table 15 also indicate a significant difference in positive and negative attitude based upon the age of the teachers. The table shows that younger teachers have more positive attitudes and that older teachers have more negative attitudes. Age seemed to make no difference in discriminatory attitudes or expression of competence to supervise instructional computing.

CONCLUSION

As the most salient literature reveals, the computer's potential as a learning aid in the schools remains tenuous due to lack of firm evidence about its educational stengths and weaknesses. Further, the way that teachers implement the machines in daily practice will certainly influence the computer's educational impact. The method by which any innovation is implemented is significantly more influential in determining the innovation's success than the actual subject of the implementation (Berman & McLaughlin, 1976).

Development and implementation of any new program brings change to the schools, and will be influenced by the beaucratic and organizational characteristics of the district and the school. Many ingrained behaviors and attitudes must be overcome to successfully bring about any lasting school change. A change which involves aquisition of new materials requires foresight and continuous planning to accomodate the needs of students in an equitable manner. Further, scarcity of resources to support the change can stifle the change effort and promote inequity through restricted opportunities for access.

Implementation of any school change is the process by which the change is diffused into the schools. Although many innovations are adopted by school administrators, most fail to be fully implemented into regular practice by the teachers (Cuban, 1986; Fullan, 1982; Berman, 1981; Berman & McLaughlin, 1976, 1978). Implementation of

any innovation is an ongoing process which is dynamic in the sense that teachers constantly shape and reshape it to fit their existing classroom needs. Thus, the better the innovation fits into the existing classroom culture, the more likely the success of its implementation.

The following assumptions, confirmed by recent research, undergird this study. Successful change can accompany innovations only if they fit easily within the existing school structure and teachers view the change as meaningful and not too hard to implement (Berman, 1981). The culture of teaching has its own set of restrictions which manifest themselves in daily classroom life and in administrative demands placed on teachers (Cuban, 1986; Jackson, 1978; Weinshank et al., 1983). As final arbitrators of classroom activities, regardless of administrative mandates, teachers will shape any implementation effort to fit their own situations (Fullan, 1982). Teachers' attitudes have an influence on instructional computing, just as on every other aspect of classroom life; more positive attitude promotes while more negative inhibits instructional computing (Weinshank et al., 1983). The shortage of computers within the schools highlights the fact that teachers' attitudes influence quantitative and qualitative access to computers. Teachers are in a position to decide how, for what purpose, when, and by whom the computers are used. Educational research has a history of excluding the teacher's viewpoint from studies about school change (Cuban,

1986; Weinshank, et al., 1983).

This study confirmed the above assumptions and concludes that a successful and ongoing implementation effort begins by including the teachers in studies about what happens in their classrooms. Furthermore, the combined top-down, bottom-up approach that employs key individuals ranging from school administrators to community members to place and use computers both at home and in the schools, has clear advantages over the unbalanced, unfortunate implementation efforts that have failed in the past simply because it includes the teachers in the plan from conception to realization.

This study was limited to Wisconsin sixth grade teachers in the Spring of 1985 and cannot be extrapolated to other states or situations. Results showed that teachers were unclear about the goals of instructional computing and therefore that they had difficulty attaching any real, supportive meaning to the innovation. For many, the program's most valuable aspect was not its educational benefits, but simply "motivation." Many teachers complained about the difficulty of merging the computer into existing time and classroom patterns, about the shortage of equipment, and about the lack of training; all of these indicate dangers to smooth classroom implementation.

Quantitative and qualitative inequities regarding instructional computing were confirmed in this study. Most schools had computers but resources were distributed unequally within school districts.

Forty-three percent of the teachers reported some student requirements for instructional computing, while some teachers reported that their schools did not have any computers at all. In schools with computers, students' access varied greatly within classrooms, from zero days to the entire school year, and seemed to depend to a certain degree upon the enthusiasm of particular classroom teachers. Less than 50% of students used computers regularly in the large majority of cases. Students who were most likely to use a computer within a classroom were those who had finished their other work, were interested, competent, above average, or had a computer at home. Although many teachers suggested "equal access" as a criterion for allocating access to the computers, patterns of usage and opinions of other teachers revealed that access was being directed toward specific groups of students, such as advanced, remedial, or those who are well-behaved.

Teachers reported that although students of average ability had the highest patterns of usage, advanced students were engaged in more high-level, cognitive exercises with the computers, while average and remedial students were engaged in lower-level activities, such as drill and practice. This measurement had room for error because it required teachers to estimate usage patterns; it is quite possible that the regular classroom teachers are unaware of the kind of activities gifted or remedial students engage in while attending specially funded classes. It would be better to measure usage

between student groups by more precise methods during the course of those activities rather than having teachers try to estimate usage patterns from memory.

The teachers' attitudes and opinions about the goals, values, and general validity of instructional computing varied widely and reflected general confusion about the program. In general, teachers believed that students do not receive enough practice to become competent users and that access to computers should be determined on the basis either of equity, or of preference for better trained teachers, or of a motivational reward system, or of remedial reinforcement. Approximately one fourth of the teachers believed that inadequate teacher training, teacher apathy, or lack of an organized program were deterrents to adequate instruction and practice time. This emphasizes the need for planning and setting direction for instructional computing, and underlines the theory that skeptics or those resistant to change must see positive results with an innovation to be motivated to incorporate that innovation into their own teaching (Cuban, 1986; Fullan, 1982).

Motivation was seen as the most beneficial aspect of instructional computing, followed by preparing students for life in a changing society, increased learning, and job preparation skills. In contrast, some teachers believed there was no benefit at all to instructional computing. Many teachers claimed that the worst aspects of instructional computing were the shortage of equipment,

time constraints of the daily schedule, inadequate teacher training, and lack of program direction. In addition to these complaints, teachers mentioned the difficulty of managing and supervising computer usage, and the inappropriateness of software to curricular needs.

About one third of the teachers in this sample had not used computers at school, mostly due to lack of training, shortage of computers, or scheduling and management problems caused by remote location of the machines. Those teachers who used computers and those who had not expressed common problems and concerns, but responded differently to them. Teachers who had not used computers reflected attitudes that were more negative, more discriminatory, and more insecure about the competence to use a computer for instructional purposes, than those expressed by teachers who had supervised computer use. Nonusing teachers were more resistant or ambivalent toward computers than the users. In fact, the nonusing group contained a few teachers who just plain refused to recognize any value to instructional computing and therefore refused to use computers at all.

Teachers who used computers were conditional accepters; they were willing enough to use the machines, but their experience had been difficult enough to cause some doubts and to lead to inequitable decisions, especially in allocating particular types of software to student ability groups. Their complaints were more sophisticated, as

their knowledge and experience on the machines was greater.

The mixture of user and nonuser teachers within the school will probably magnify the existing confusion about the objectives of instructional computing and the frustration with implementing it; this can promote both quantitative and qualitative inequity among students. And if a school had teachers who were all users, then the inequities would be related more to curricular problems and technical support.

Age also affected teacher attitudes toward implementation of instructional computing; younger teachers expressed more positive attitudes. This is consistent with results of a study by the Rand Corporation which document that the length of the teaching career is negatively associated with successful implementation of changes; older, more experienced teachers were less likely to change their teaching practices (Berman & McLaughlin, 1978).

Studies about instructional media, including radio and television, cite lack of equipment, lack of training, inconvenience, and no relevancy to the standard curriculum as major reasons why the media were not used either daily or, in some cases, on any regular basis (Cuban, 1986). This study showed that teachers believed these same four issues were highly problematic for instructional computing. If previous experience is a guide, then the future success of computers in the elementary schools cannot be guaranteed without supportive teachers who are committed to the instructional computing

program. Commitment, understanding of the goals, resources, and skills are directly related to successful change and implementation of innovations within schools (Sarason, 1982).

This study suggests a need to investigate methods of setting goals for both instructional computing and provision of teacher training. Whereas previous technological innovations had mostly top-down implementation efforts in the schools, with pressure coming from the administration to implement, computers have been a mix of a top-down, bottom-up approach in which teachers have been involved in the effort (Cuban, 1986; Sheingold et al., 1981). We need to know how teachers determine goals for instructional computing and communicate those goals to other teachers. This study provided a rough look at training, but a more detailed, indepth investigation is necessary to determne what kinds of training opportunities teachers have and the effectiveness of training when it is applied to the classroom situation.

The provision of training and better equipment is not enough, however. Training should be tailored to the classes of opinion and attitude that already exist in the school, to bring users and nonusers closer together, to answer their specific complaints, to enhance familiarity among current nonusers and to encourage and support current users. Such an effort might decrease the inequitable decisions that arise under the conditions reported in this study. One model for change and implementaton will not suit all situations,

but any effort at change needs to use a flexible model which can be tailored to specific situations. Different diffusion patterns have been noted as teachers tailor innovations to meet their own classroom environment (Cuban, 1986; Fullan, 1982).

A good start would be to follow the example set by the St. Paul, Minnesota school district, which trained a cadre of teachers, who agreed in turn to train other teachers within their school district. This sort of "train the trainer" approach has great potential for schools because teachers would be brought together to support each other through training and during the process would undoubtedly set some goals for instructional computing as well. In such an approach teachers could address the real problems they are having in the classroom, offer realistic solutions, acknowledge ownership of the problems, and infuse real meaning to the program.

Further, if the leaders of the schools, the principals, are trained along with the first group of teachers and are then involved in the training process for others, the implementation effort will have added strength. The bottom-up effect of such a plan, combined with the top-down interest necessary to get it started and support the effort would give the implementation approach a good chance of success.

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TABLE 1

Do Students Receive Enough Instruction and Practice to Become Competent?

VARIABLE	N	%
Yes	81	23
No	271	77
TOTAL	352	100

If No, Why Not?	N	%*
Not Enough Access to Computers	155	57.2
Can't Take Time from Curriculum	148	54.6
Teacher Training or Apathy	77	28.4
No Organized Program	64	23.6
Type of Available Software	14	5.2
Dif. Brand or Incompatible Equipment	3	1.1
No Student Interest	2	.7

* Respondents = 271. Total Percent is greater than 100 because teachers wrote more than one answer.

TABLE 2

How Many Students Use Computers on a Regular, Weekly Basis?

REGULAR STUDENT USERS	N	%
10% or Less	142	40.3
11 - 25%	75	21.3
26 - 50%	64	18.2
More than 50%	71	20.2
TOTAL	352	100.

Reasons Less Than 50% Students Use Computers Weekly

VARIABLE	N	%*
Choices		
Central Location Limits Use	168	61.1
Can't Take Time from Regular Curric.	161	58.5
Teachers Not Trained	160	58.2
Funds Limit to Specific Student Group	32	11.7
Funds Limit to Curric Area	15	5.5
Write-Ins		
Lack Enough Computers	51	18.5
Lack Necessary Software	27	9.8
Undeveloped Program	20	7.3
Lack of Student Interest	7	2.5

Respondents = 275

* Total Percent is greater than 100 because teachers indicated more than one answer.

TABLE 3

Which Students Use Computers in Classrooms?

DO ALL STUDENTS IN CLASS USE PERIODICALLY?	N	%
Yes	168	72.4
No	64	27.6
TOTAL	232	100.
IF NO, WHICH STUDENTS ARE MORE LIKELY TO USE?	**N**	**%**
Finished with Work, Interested, Competent	14	21.8
Those Interested	13	20.3
Above Average With Interest	12	18.7
Have Computer at Home	10	15.6
Remedial, Poorly Motivated	5	7.8
Advanced Boys	4	6.3
Gifted or Remedial	4	6.3
Good Behavior	1	1.6
More Aggressive	1	1.6
TOTAL	64	100.

TABLE 4

Type of Usage by Student Groups - Percentages & ANOVA

VARIABLE	GIFTED		AVERAGE		REMEDIAL	
	MEAN	SD	MEAN	SD	MEAN	SD
Write Programs	11.4	20.9	6.9	15.6	2.2	9.9
Word Processing	7.7	14.8	8.5	19.5	2.5	8.8
Tutorial	5.1	10.3	8.9	12.9	9.1	16.2
Drill & Practice	13.7	21.7	31.8	23.6	26.8	28.6
Demonstration	2.7	6.4	3.9	7.7	2.7	6.8
Simulation	7.3	14.4	7.1	12.6	2.7	8.1
Games	20.5	27.0	29.2	26.1	17.0	22.8
Spreadsheets	.1	.7	.0	.1	--	--
Data Base	.4	2.7	.8	5.0	.1	.9
Telecommunications	.0	.3	--	--	--	--
Robotics	.3	3.2	.1	.9	--	--
Other	.1	.5	.2	1.7	.1	.7

FRIEDMAN TWO-WAY ANOVA: Total Usage Between Student Groups

VARIABLE	MEAN RANK	CHI-SQUARE	DF	SIGNIFICANCE
SUM OF USE FOR:		38.26	2	.00
Gifted	1.89			
Average	2.31			
Remedial	1.80			

N = 251

TABLE 5

Percentages of Usage Sorted by High- and Low-Level Skills

VARIABLE	MEAN	SD	MAX
HIGH LEVEL			
Write Programs	6.79	12.16	100.00
Word Processing	6.18	11.23	83.33
Simulation	5.67	9.12	53.33
MEAN TOTAL	6.21	6.44	43.89
LOW LEVEL			
Tutorial	7.69	10.09	50.00
Drill & Practice	24.01	19.48	100.00
Demonstration	3.10	5.70	30.00
MEAN TOTAL	11.60	7.93	33.33

Minimum = .00

N = 251

TABLE 6

Percentages of High & Low Level Usage by Student Groups

VARIABLE	GIFTED		AVERAGE		REMEDIAL	
	MEAN	SD	MEAN	SD	MEAN	SD
High Level	26.21	30.76	22.40	29.99	7.29	15.81
Low Level	21.48	27.56	44.73	28.11	38.36	36.61

N = 251

TABLE 7

Wilcoxon Matched-Pairs Signed-Ranks Tests of High-Level Use Between Gifted, Average and Remedial Student Groups

GIFTED HIGH LEVEL WITH AVERAGE HIGH LEVEL	MEAN RANK	N
- Ranks (Average High < Gifted High)	78.17	106
+ Ranks (Average High > Gifted High)	91.67	59
Ties (Average High = Gifted High)		86
Z = -2.34		
P = .01		

GIFTED HIGH LEVEL WITH REMEDIAL HIGH LEVEL	MEAN RANK	N
- Ranks (Remedial High < Gifted High)	69.01	124
+ Ranks (Remedial High > Gifted High)	39.28	9
Ties (Remedial High = Gifted High)		118
Z = -9.21		
P = .00		

AVERAGE HIGH LEVEL WITH REMEDIAL HIGH LEVEL	MEAN RANK	N
- Ranks (Remedial High < Average High)	73.48	138
+ Ranks (Remedial High > Average High)	63.50	7
Ties (Remedial High = Average High)		106
Z = -9.57		
P = .00		

TOTAL N = 251

TABLE 8

Wilcoxon Matched-Pairs Signed-Ranks Tests of Low-Level Use Between Gifted, Average and Remedial Student Groups

GIFTED LOW LEVEL WITH AVERAGE LOW LEVEL	MEAN RANK	N
- Ranks (Average Low < Gifted Low)	47.00	10
+ Ranks (Average Low > Gifted Low)	92.03	168
Ties (Average Low = Gifted Low)		73
Z = -10.89		
P = .00		

GIFTED LOW LEVEL WITH REMEDIAL LOW LEVEL	MEAN RANK	N
- Ranks (Remedial Low < Gifted Low)	69.92	26
+ Ranks (Remedial Low > Gifted Low)	73.67	119
Ties (Remedial Low = Gifted Low)		106
Z = -6.86		
P = .00		

AVERAGE LOW LEVEL WITH REMEDIAL LOW LEVEL	MEAN RANK	N
- Ranks (Remedial Low < Average Low)	106.53	95
+ Ranks (Remedial Low > Average Low)	75.09	87
Ties (Remedial Low = Average Low)		69
Z = -2.52		
P = .01		

TOTAL N = 251

TABLE 9

Best Aspects of Instructional Computing

VARIABLE	N	%*
Motivation - Interest, Challenge, Reward, Change of Pace	117	40.1
Future - Technology, Keep With Times, Society, Awareness	54	19.2
Helps or Increases Learning	33	11.3
Job Prep. - Typing, Word Processing, Job & Life Skills	29	10.0
Nothing Good About It	20	6.9
Remediation	19	6.5
Individual Level	19	6.5
Logic - Problem Solving, Critical Thinking	17	5.8
Variety - Potential Versatility of Software	14	4.8
Enrichment for Advanced	11	3.8
Relevant Extension of Basics - Drill	10	3.4
Age - Can begin early to develop sophisticated skills	5	1.7
Independent Tool - Can do it Without Teacher	5	1.7
Not Mandatory - Optional for Teachers	5	1.7
Mandatory - Teachers Must Learn, Forces Me	3	1.0

No Response = 78
Valid Cases = 291

* Total Percent is greater than 100 because teachers indicated more than one answer. (All write ins)

TABLE 10

Criteria Suggested by Teachers for Determining Access

VARIABLE	N	%*
Equal Access - All Students have equal access	93	36.9
Better Teachers - Trained Teachers Get First Choice	68	27.0
Motivation - Reward, If no behavior problems	65	25.8
Need - Remedial Reinforcement	62	24.6
Ability - Above Average, Enrichment, Independent Workers	49	19.4
Interest - Those Interested, First Come	46	18.3
Older Students Should Have Priority	26	10.3
Would Not Use Computers	9	3.6

N = 252

* Total percentage is greater than 100 because teachers indicated more than one response.

TABLE 11

Worst Aspects of Instructional Computing

VARIABLE	N	%*
Lack Equipment, Software, Space	107	36.5
Daily Schedule - Lack Time, Neglect Basics	74	25.3
Inadequate Teacher Training	60	20.5
Lack Program Direction	52	17.7
Poor Quality Software	32	10.9
Too Expensive, Can't Afford, Not Justified	32	10.9
Lack Prep. Time to Plan and Select Software	28	9.6
Questionable Educational Value	24	8.2
Misuse - Students Only Interested in Games, Use as a Toy, Lazy, Waste Time	17	5.8
Teacher Apathy or Fear of Change	12	4.1
Misconception that it will Solve Instructional Problems or that we all Need it	11	3.8
Hard to Supervise, Equipment Easily Damaged	10	3.4
Dehumanizing, Isolating	4	1.4
Defective Equipment - Hardware or Software	3	1.0
Distraction to Class	3	1.0
Inequitable - Only Learn if Teacher Interested	1	0.3

No Response = 76
Valid Cases = 293

* Total Percent is greater than 100 because teachers indicated more than one answer. (All write ins)

TABLE 12

Major Problems Experienced in Your School

VARIABLE	N	%*
Lack Time	131	47.6
Lack Computers	101	36.7
Lack Teacher Training	90	32.7
Hard to Supervise Use & Grade	65	23.6
Lack Program Objectives	64	23.3
Lack Quality or Appropriate Software	52	18.9
Remote Locations	21	7.6
No Teacher Interest	16	5.8
Lack Administrative Support or Funds	12	4.4

Valid Cases = 275

* Total Percent is greater than 100 because teachers indicated more than one answer.

TABLE 13

Have You Supervised Computer Use This School Year?*

VARIABLE	N	%
Yes	226	64.2
No	116	35.8
TOTAL	352	100.

Reasons Given for Having Not Supervised Computer this year

VARIABLE	N	%**
Not Enough Training to Feel Comfortable	81	64.3
Lack Computers to Schedule All	76	60.3
Difficult to Schedule in Other Room	60	47.6
Can't Supervise in Remote Location	43	34.1
Lack Desire	22	17.5
Write Ins		
Another Adult Supervises My Students	19	15.1
Lack Time from Curriculum	12	9.5
Restricted to Other Uses	9	7.1
Lack Appropriate Software	2	1.6

Respondents = 126

* Includes only teachers in school with computers

** Total Percent is greater than 100 because teachers indicated more than one answer.

TABLE 14

Opinion Differences by Age, Sex, Use/Nonuse*

SUBJECT	VARIABLE	SUGGESTED MORE BY
Access Criteria	Equal Access	Females
	Need, Remedial	Age 51/Older
	Student Ability	Nonusers
Best Aspects	Job Preparation	Males
	Nothing Good	Nonusers
Worst Aspects	Preparation Time	Females
	Lack of Equipment	Age 35/Younger
	Questionable Value	Age 51/Older
Major Problems	Remote Location	Age 35/Younger
	Management	Age 35/Younger
	Teacher Interest	Age 36 - 50
	Lack of Software	User
	Lack of Training	Nonuser

* All relationships significant at alpha .05 or less

TABLE 15

T Tests on Attitudes Noted Between Users and Nonusers; Age Groups

VARIABLES	N	M	SD	DF	T	P
POSITIVE*						
Nonuser	143	11.72	2.97			
User	226	9.65	2.83	291.28	6.64	.000
40 or Younger	176	9.99	2.90			
41 or Older	193	10.87	3.14	366.96	-2.79	.006
NEGATIVE*						
Nonuser	143	16.15	3.78			
User	226	18.10	3.98	313.71	-4.74	.000
40 or Younger	176	18.10	3.95			
41 or Older	193	16.65	3.96	364.11	3.52	.000
DISCRIMINATORY*						
Nonuser	143	23.93	4.83			
User	226	25.85	4.63	292.47	-3.79	.000
COMPETENCY*						
Nonuser	143	32.18	5.94			
User	226	28.01	5.73	294.02	6.67	.000

* Lower Means are more strongly positive, more strongly negative, more strongly discriminatory, and more competent.

INSTRUCTIONAL COMPUTING (IC) QUESTIONNAIRE

1. How would you characterize each of the following groups in your community in terms of their support for IC? Use the following scale:
   5 = Very strong support; 4 = Strong support; 3 = Moderate support;
   2 = Weak support; 1 = Very weak support: (write a number in each box)

   [ ]School board [ ]District administrators [ ]Principal [ ]Teachers
   [ ]Students [ ]Parents [ ]YOU

2. Does your school use computers for instruction? [ ]YES [ ]NO
   IF YES, answer 'a - n' below; IF NO, skip to question 5:

a. How many computers does your school have?_____

b. Check 1 statement that most accurately reflects your school's situation:
   [ ] We need more computers.
   [ ] We have just the right number of computers.
   [ ] We have too many computers; those we have frequently sit idle.

c.

Does your school have a written, formal plan for:	YES	UNDER DEVELOPMENT	NO	DON'T KNOW
1. Instructional uses of microcomputers?	[ ]	[ ]	[ ]	[ ]
2. Computer literacy curriculum?	[ ]	[ ]	[ ]	[ ]
3. Implementation of computer education?	[ ]	[ ]	[ ]	[ ]

d. Are all students required to learn the use of computers? [ ]YES [ ]NO

e. Are your students given a separate grade for their work with computers?
   [ ]YES [ ]NO

f. In general, what percentage of students use computers on a regular, weekly basis? (Check ONE box below)
   [ ]10% or less [ ]11-25% [ ]26-50% [ ]More than 50%

   IF YOU ANSWERED LESS THAN 50% above, indicate reasons why more students do not receive instructional computing weekly. (Check ALL that apply)

   [ ] Specific funds restrict IC to special student groups (eg. gifted)
   [ ] Specific funds restrict IC to special curricular area (eg. science)
   [ ] Teachers are not adequately trained in the use of computers
   [ ] Computers are "centralized" in a few areas and access is difficult
   [ ] We can't take time from the regular curriculum
   [ ] Other _____

g. Do you feel that most students receive enough instruction and practice time to truly become competent at and comfortable using computers?
   [ ]YES [ ]NO

   IF NO, why not?

h. Is IC integrated with the basic curriculum? [ ]YES [ ]NO
   IF YES, in which subject areas?_____

2. continued

i. How is access determined?
[ ] Students elect to use the computer; mark those that apply:
[ ] Rotating schedule for equal amounts of time (eg. 10 min. shifts)
[ ] Students who finish their work first use the computer.
[ ] Regardless of finished work, first-come, first-served.
[ ] Other, please explain _____

[ ] Teacher assigns students to use the computer; mark those that apply:
[ ] Specific groups (eg. Assignment for entire reading or math class, etc., by group)
[ ] Remedial students mostly are assigned
[ ] Advanced students mostly are assigned
[ ] Other, please explain _____

j. Does the district require computer training for teachers? [ ]YES [ ]NO

k. Check ALL statements below which describe the way your school acquired microcomputers:
[ ] Solely upon administrative recommendation
[ ] After 5 or more planning sessions including teachers
[ ] Before teachers were trained to operate the computers proficiently
[ ] Before teachers knew how to assimilate CAI into their teaching
[ ] Hardware purchases were based upon particular software needs which had been determined by a curriculum plan

l. About how many meetings did you attend to plan for computer implementation before your school purchased computers? (Check one)
[ ]0 [ ]1-2 [ ]3-4 [ ]5-6 [ ]7-8 [ ]Other, specify _____

m. What are some of the major problems you've had with instructional computing, and what solutions have you tried?

n. In the matrix below, estimate the percentage of total computer time spent on the various TYPES of IC for each of the FOUR STUDENT GROUPS:

	GIFTED/TALENTED	AVERAGE	REMEDIAL	HANDICAPPED
Writing programs				
Word processing				
Tutorial				
Drill and Practice				
Demonstration				
Simulation				
Instructional Games				
Spreadsheets				
Databases				
Telecommunications				
Robotics				
Other				
TOTAL	100%	100%	100%	100%

3

3. Have YOU supervised computer use while teaching this year? [ ]YES [ ]NO
IF YES, answer 'a - j': IF NO, skip to question 4:

a. Where are those computers located?
[ ] Computer Lab [ ]IMC [ ] Your classroom

b. List the numbers of computers _____, and students_____ in the room.

c. About how many students are assigned per computer? _____

d. How often does the average student "use a computer" in that setting?
[ ] Daily [ ] Once every two weeks
[ ] Twice per week [ ] Once per month
[ ] Once per week [ ] Other _____

e. Approximately how long (in minutes) does each student "use a computer" per session? _____

f. Do all students in your class use computers at periodic intervals?
[ ]YES [ ]NO

IF NO, which students are likely to use the computers?

g. How do you usually use computers in instruction? (Check ALL that apply.)
[ ] I incorporate computers into unit plans for teaching certain subject areas. Which subjects?_____
[ ] I use computers independently of other subjects being taught.
[ ] I treat computers as a separate subject (eg. Teach about computers)

h. While part of the class uses computers, the other students are usually engaged in: (check ONE box)
[ ] A related activity (eg. Computer group does math drill while others do math worksheet practicing the same concept)
[ ] An unrelated activity (eg. Computer group does math drill while others do science reports)
[ ] There are enough computers for all students to use them at once.

i. The method I use for recording computer use is: (Check ALL that apply)
[ ] With my guidance, students keep their own records.
[ ] I do not keep records.
[ ] I keep records of time spent on a computer by each student.
[ ] I keep records of software used by each student.
[ ] I keep records of scores earned on software programs.
[ ] I evaluate programs that students write
[ ] Other, please explain _____

j. IF THE COMPUTERS ARE LOCATED IN YOUR CLASSROOM, answer 1 - 3 below:

1. How long can you keep the computers in your room? (Check one box)
[ ] One week [ ] One semester
[ ] Two weeks [ ] Entire school year
[ ] One month [ ] Other, specify _____

3. j. continued

2. In general, how often are the computers used?
[ ]Daily [ ]Once every two weeks
[ ]Twice per week [ ]Once per month
[ ]Once per week [ ]Other_____

3. In general, how many hours are the computers actually used during each day that they are turned on? _____

4. If you HAVE NOT supervised computer use during this school year, check all below that indicate why not:
[ ] I don't like to use computers.
[ ] I haven't had enough training to feel comfortable using computers.
[ ] I hesitate to send students from my class to use computers where I cannot supervise them.
[ ] Scheduling students to use computers in other rooms difficult
[ ] There are not enough computers for all students in my class to use the machines in time allowed
[ ] Other_____

5. How many meetings have you attended during this school year to plan for computer implementation? (Check ONE box below)
[ ]0 [ ]1-2 [ ]3-4 [ ]5-6 [ ]7-8 [ ]Other, please specify_____

6. In your judgment, do students learn better individually or in groups when using computers? [ ]INDIV [ ]GROUPS

7. If students are "grouped" on machines, do you feel the IC is truly individualized? [ ]YES [ ]NO [ ]UNCERTAIN

8. Suppose you worked in a school which did not have enough computers for all students to use. List 2 or 3 criteria you would use to determine access to the machines. Please EXPLAIN your answer.

9. Check any special training you have had about microcomputers or IC?
[ ] Teacher Inservice - How many hours?_____
[ ] Technical School - How many full semester courses? _____
[ ] College - How many computer credits? _____
[ ] Local computer classes offered by businesses or private persons in the area - How many hours?_____
[ ] Other, please explain _____

10. If you were not responsible for teaching with computers, would you take a computer class? [ ]YES [ ]NO

11. Do you have a computer at home? [ ]YES [ ]NO
IF YES, why did you purchase it?_____

12. Do you belong to a computer users group? [ ]YES [ ]NO

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Mark one box per line to indicate how you feel about each of the following statements concerning CAI; Use the following scale: SA = STRONGLY AGREE
A = AGREE U = UNDECIDED D = DISAGREE SD = STRONGLY DISAGREE

	SA	A	U	D	SD
13. Microcomputers for student use:					
a. Are a welcome addition to school curricula	[ ]	[ ]	[ ]	[ ]	[ ]
b. Are a necessary investment for schools	[ ]	[ ]	[ ]	[ ]	[ ]
c. Complicate my job more than I'd like	[ ]	[ ]	[ ]	[ ]	[ ]
d. Enhance the quality of education	[ ]	[ ]	[ ]	[ ]	[ ]
e. Take too much time away from the basic subjects	[ ]	[ ]	[ ]	[ ]	[ ]
f. Are a fad whose popularity will fade	[ ]	[ ]	[ ]	[ ]	[ ]
h. Are very helpful in teaching language arts	[ ]	[ ]	[ ]	[ ]	[ ]
i. Should be taught as a separate subject	[ ]	[ ]	[ ]	[ ]	[ ]
j. Are more appealing to boys than to girls	[ ]	[ ]	[ ]	[ ]	[ ]
k. Are more necessary for boys than for girls	[ ]	[ ]	[ ]	[ ]	[ ]
14. I have enough skill to feel comfortable teaching:	SA	A	U	D	SD
a. With computers (using software).	[ ]	[ ]	[ ]	[ ]	[ ]
b. About how a computer works (basic logic).	[ ]	[ ]	[ ]	[ ]	[ ]
c. BASIC programming on an introductory level.	[ ]	[ ]	[ ]	[ ]	[ ]
d. BASIC programming on an advanced level.	[ ]	[ ]	[ ]	[ ]	[ ]
e. Pascal programming	[ ]	[ ]	[ ]	[ ]	[ ]
f. Logo	[ ]	[ ]	[ ]	[ ]	[ ]
g. Using telecommunications	[ ]	[ ]	[ ]	[ ]	[ ]
h. Using robotics	[ ]	[ ]	[ ]	[ ]	[ ]
15. Handicapped children are not likely to become very good at using computers.	[ ]	[ ]	[ ]	[ ]	[ ]
16. The limited number of student computers presents problems in scheduling access for ALL students.	[ ]	[ ]	[ ]	[ ]	[ ]
17. More computers would:					
a. Promote access for more students	[ ]	[ ]	[ ]	[ ]	[ ]
b. Ease scheduling of CAI for my classes	[ ]	[ ]	[ ]	[ ]	[ ]
c. Be difficult to supervise	[ ]	[ ]	[ ]	[ ]	[ ]
18. Priority for IC should be given to:	SA	A	U	D	SD
a. Gifted and talented students.	[ ]	[ ]	[ ]	[ ]	[ ]
b. Remedial students.	[ ]	[ ]	[ ]	[ ]	[ ]
c. Those who finish their other work early.	[ ]	[ ]	[ ]	[ ]	[ ]
d. Those students in a computer club.	[ ]	[ ]	[ ]	[ ]	[ ]
19. Computers should be reserved for teaching:	SA	A	U	D	SD
a. Math, science & social studies only	[ ]	[ ]	[ ]	[ ]	[ ]
b. Language arts and reading only	[ ]	[ ]	[ ]	[ ]	[ ]
c. BASIC or Logo programming only	[ ]	[ ]	[ ]	[ ]	[ ]
d. In many subjects, but without programming	[ ]	[ ]	[ ]	[ ]	[ ]
e. In many subjects, with programming	[ ]	[ ]	[ ]	[ ]	[ ]
f. At the high school level, since mature students will better understand computing in general	[ ]	[ ]	[ ]	[ ]	[ ]
20. Most educational software is:					
a. Of inferior quality and lacks good content	[ ]	[ ]	[ ]	[ ]	[ ]
b. More appealing to boys than to girls	[ ]	[ ]	[ ]	[ ]	[ ]

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	SA	A	U	D	SD
21. Money spent on instructional computing at the elementary school level would be better spent in other curricular areas, for other materials	[ ]	[ ]	[ ]	[ ]	[ ]
22. Our principal seems:					
a. Knowledgable about computer education	[ ]	[ ]	[ ]	[ ]	[ ]
b. Helpful concerning computer implementation	[ ]	[ ]	[ ]	[ ]	[ ]
c. Interested in computers, but lacks necessary knowledge to help me implement them	[ ]	[ ]	[ ]	[ ]	[ ]
d. Uninterested in computer education	[ ]	[ ]	[ ]	[ ]	[ ]

23. In general, the best thing about computer education is:

24. In general, the worst problem with computer education is:

25. Check the statement that describes your school district:
[ ] Urban (city of 50,000 or more)
[ ] Suburban (adjacent to a city of 50,000 or more)
[ ] Medium city (city of 15,000 - 49,999)
[ ] Small city (city of 3,000 - 14,999)
[ ] Rural (less than 3,000)

26. Please estimate the racial composition of your school by percent.
___Black ___Hispanic ___Asian ___Native American ___White ___Other

27. How many years have you been teaching? (include this year) _____
28. How many years have you taught at this school? (include this year) _____
29. List any administrative duties you perform _____
30. Your sex? _____
31. Your age? _____
32. Name & phone number (optional) _____

THANK YOU VERY MUCH for taking the time to answer these questions!

PLEASE RETURN TO:

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